LISTING OF THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims:

Claims 1 - 116 (Cancelled)

117. (New) A simulator or measurement apparatus for use in a ball game where a ball is hit from a stationary position, the apparatus including a ball, a connecting means, a base and a measurement means, wherein the ball is connected by the connecting means to the base, characterised in that the connecting means is operable to provide a plurality of degrees of freedom to the movement of the ball; the connecting means is substantially in a unique arrangement for each position of the ball; and the connecting means is operable to allow the connected ball, when struck by an object, to substantially replicate some or all of the motion characteristics of an unconnected ball, over a distance sufficient to measure such motion characteristics, and where the measurement means is operable to measure motion characteristics of the connected ball over the distance when such motion characteristics are substantially replicated, wherein the connecting means comprises members of rigid construction and wherein the connecting means is operable to provide at least three degrees of freedom and a replicated motion characteristic is substantially straight line movement.

118. (New) A simulator or measurement apparatus according to Claim 117, wherein the connecting means comprises a plurality of joints; the joints are interconnected in series, with interconnecting members between each joint; and an interconnecting member connects the ball to a first of the joints and an interconnecting member connects a last of the joints to the base.

119. (New) A simulator or measurement apparatus according to Claim 118, wherein one or more of the joints are pivot joints; and each pivot joint is operable to rotate in one plane.

120. (New) A simulator or measurement apparatus according to Claim 119, wherein the ball is free to move in three-dimensional space over the limited region where each pivot joint has its interconnected members at a relative angle which is less than 180° and where the pivot joints remain

capable of further rotation; and motion characteristics are measured while the ball remains in this region.

121. (New) A simulator or measurement apparatus according to Claim 119, wherein the distance between the centre of the ball and the axis of the first pivot is in the range 130 mm to 200 mm; the distance between the axis of the first pivot and the axis of the second pivot is in the range 10 mm to 40 mm; and the distance between the axis of the second pivot and the axis of the third pivot is in the range 20 mm to 70 mm.

122. (New) A simulator or measurement apparatus according to Claim 121, wherein the distance between the centre of the ball and the axis of the first pivot is 165 mm; the distance between the axis of the first pivot and the axis of the second pivot is 20 mm; and the distance between the axis of the second pivot and the axis of the third pivot is 50 mm.

123. (New) A simulator or measurement apparatus according to Claim 121, wherein prior to the shot, the principal axis of the interconnecting member between the ball and the first pivot joint is oriented in a substantially horizontal plane and the angle, between the principal axis and the intended direction of motion of the ball, is less than 90° on the side adjacent where the ball is struck, wherein the angle is around 78° or in a range between 73° and 83°.

124. (New) An apparatus according to Claim 119, which includes a spring supporting means, and wherein the spring supporting means is operable to support the interconnecting member between the ball and the first pivot joint such that its principal axis is horizontal or at a small angle to horizontal, as required, prior to the shot; the spring supporting means is operable to permit the ball and the interconnecting member between the ball and the first pivot joint to freely move vertically upwards; the spring supporting means is operable to prevent the ball and the interconnecting member between the ball and the first pivot joint from moving vertically downwards due to the force of gravity, but is operable to allow it to move vertically downwards where a significantly greater force is applied; and where the spring supporting means is operable to return the ball and the interconnecting

member between the ball and the first pivot joint to their original positions when the significantly greater force is removed.

125. (New) A simulator or measurement apparatus according to Claim 118, wherein the movement of a joint on the connecting means is limited by a buffer means where the limits of the buffer means are outside the range of movements which are measured by the measurement means.

126. (New) A simulator or measurement apparatus according to Claim 118, which includes a docking means, wherein prior to the shot, the docking means is operable to dispose the ball in a starting position relative to other parts of the apparatus; the docking means comprises an engagement member fixed relative to the interconnecting member between the ball and the first joint and a corresponding engagement member fixed relative to the base; the engagement members being operable, when engaged with each other, to dispose the ball in the desired starting position prior to the shot and being operable to freely disengage when a shot is taken.

127. (New) A simulator or measurement apparatus according to Claim 126, wherein one or both of the engagement members comprises a tapering or guiding surface; and the progressive engagement of the engagement members urges the ball to the starting position.

128. (New) A simulator or measurement apparatus according to Claim 117, wherein the ball game is golf in which the ball is hit in a range of golf shots, including a drive and a putting shot.

129. (New) A simulator or measurement apparatus, for use in a ball game where a ball is hit from a stationary position, the apparatus including a ball, a connecting means and a base, wherein the ball is connected by the connecting means to the base and wherein the connecting means comprises an elongated rigid member between the ball and a joint connected to the base, or to other parts connected to the base, and about which the arm principally moves when the ball is struck characterised in that the elongated rigid member is manufactured from high strength-to-weight material; all or part of its external surface is tapered with its minimum dimensions closer to the ball;

and the inertia of the connecting means about the joint is significantly less than the inertia of the ball about the joint, wherein the ball game is golf and the ball is a real or simulated golf ball.

130. (New) A simulator or measurement apparatus according to Claim 129, wherein the length of the elongated rigid member, measured from the centre of the ball to the centre of the joint about which the arm principally moves when the ball is struck, is between 150 mm and 200 mm.

131. (New) A simulator or measurement apparatus according to Claim 129, wherein the elongated rigid member is of circular cross section; its outer diameter in the region adjacent the ball is in the range 8-14 mm; and its outer diameter in the region away from the ball is in the range 14-20 mm.

132. (New) A simulator or measurement apparatus according to Claim 129, wherein the elongated rigid member is hollow, wherein the elongated rigid member has an internal bore, substantially of circular cross section; and its internal diameter is in the range 5-9 mm.

133. (New) A simulator or measurement apparatus according to claim 129, wherein the elongated rigid member is manufactured from hardened aluminium alloy or hardened steel.

134. (New) A simulator or measurement apparatus according to Claim129, wherein the elongated rigid member and components attached to the elongated rigid member are arranged such as to minimise mass and to position it as close as possible to the joint about which the elongated rigid member principally moves when the ball is struck.

135. (New) A simulator or measurement apparatus, for use in a ball game where a ball is hit from a stationary position, the apparatus including a ball, a connecting means, a base and a measurement means, where the ball is connected by the connecting means to the base, characterised in that the connecting means comprises an elongate member which is connected to the ball; the elongate member and the ball are operable to rotate collectively about an axis which is the elongate axis of the elongate member; the apparatus includes a sensing means which is operable to measure rotation

of the shaft; and the sensing means communicates with the measurement means, wherein the elongate member is a rigid member such as a rigid shaft and wherein the sensing means is associated with the distal end of the elongate member.

136. (New) A simulator or measurement apparatus according to Claim 135, wherein the sensing means comprises a vane with irregularities; the vane is connected to the elongate member; the sensing means further comprises a detecting means which is operable to detect the passage of irregularities on the vane; the sensing means communicates with the measurement means; and the measurement means is operable to measure the rotation speed of the ball.

137. (New) A simulator or measurement apparatus according to Claim 135, wherein the measurement means is operable to measure the linear speed of the ball and is operable to estimate the loft of the ball from measurement of the rotation speed and linear speed of the ball.

138. (New) A simulator or measurement apparatus, for use in a ball game where a ball is hit from a stationary position, the apparatus including a ball, a connecting means, a base and a measurement means, wherein the ball is connected by the connecting means to the base, characterised in that the connecting means is operable to allow the ball to spin about two different set axes; the measurement means is operable to measure the rates of rotation about these two set axes; the measurement means is operable to determine the rotation characteristics which the ball would have had about its natural spin axis if it had not been restrained by the set axes, wherein the rotation characteristics include or relate to the back spin and side spin of the ball.

139. (New) A simulator or measurement apparatus according to Claim 138, which is operable to repeatedly alter the axis between the different set axes positions; and the measurement means is operable to ascertain average values to more accurately determine the rotation characteristics which the ball would have had about its natural spin axis if it had not been restrained by the set axes.

140. (New) A simulator or measurement apparatus according to Claim 138, which is operable to alter the axis between the two different set axes positions without substantially altering the height or position of the ball.

141. (New) A simulator or measurement apparatus, for use in a ball game where a ball is hit from a stationary position, the apparatus including a ball, a connecting means, a base and a measurement means, wherein the ball is connected by the connecting means to the base,
characterised in that the apparatus includes sensor means which produce input signals when the ball is hit; and the measurement means is operable to determine the motion characteristics of an unconnected ball by comparison of these input signals to input signals corresponding to previous shots with known motion characteristics.

142. (New) A simulator or measurement apparatus according to Claim 141, wherein the measurement means includes an artificial neural-type intelligence means.

143. (New) A simulator or measurement apparatus according to Claim 141, wherein the artificial neural-type intelligence means has been trained using a ball striking means, wherein training inputs to the artificial neural-type intelligence means are determined by striking the connected ball with the ball striking means, and training outputs to the artificial neural-type intelligence means are determined by striking an unconnected ball with the ball striking means in like manner and measuring its motion characteristics.